

Name _____

NASA/Tropical Rainfall Measuring Mission (TRMM)

Topic #4: Lightning

Activity #1: Narrative on Lightning

OBJECTIVE: To introduce concepts and vocabulary related to lightning formation.

WHAT'S HAPPENING?

At any given instant, there are more than 2,000 thunderstorms taking place throughout the world. All these storms combine to produce about 100 lightning flashes per second, each one with temperatures of more than 54,000 ° F which is hotter than the surface of the Sun. The Lightning Imaging Sensor aboard the **TRMM** satellite promises to expand scientists' capabilities for surveying lightning and thunderstorm activity. For example, the imager's field of view allows the sensor to observe a point on Earth for 80 seconds, a sufficient time to estimate the flashing rate that tells researchers whether a storm is growing or decaying. One of the major findings has been that 90% of lightning strikes over land. Scientists believe this may be a result of stronger **convection currents** that are set in motion as warm air rises over the hot sunlit land.

One of the unique features of TRMM 's instrumentation is that it allows scientists to peer inside the cloud. Using **radar**, scientists study the reflection of cloud drops, raindrops and ice crystals within various parts of the **energy spectrum** and construct a picture of what the cloud looks like inside. As warm humid air rises (called an **updraft**), the air cools to its **dew point** and a cloud begins to form. As the water vapor in the upper portions of the cloud becomes **super-cooled**, raindrops and hail begin to form and fall, dragging down cooler air and producing downdrafts. Updrafts continue to feed warm humid air into the maturing storm cloud. When downdrafts grow in strength, they eventually choke off the updraft, which starves the storm of its supply of humid air. When this occurs, the storm dies.

One of the distinctive side effects of a thunderstorm is lightning which is responsible for the death of hundreds of people and millions of dollars of property damage each year. As a thunderstorm develops, rising ice crystals collide with falling hailstones that form from ice crystals and super-cooled raindrops. The hail strips the electrons from the ice. The top of the cloud becomes predominately positive and the bottom mostly negative with scattered positive areas at its base. Negative charges in the lower cloud cause positive charges to cluster in regions on the ground below the cloud. Although air serves as an **insulator**, eventually the static charge or electrical potential is large enough that a negative spark is launched from the lower cloud to the ground. The strike can also discharge to a positive region in the cloud. The lightning superheats the air creating shock waves that produce thunder.

Large vertical storms over land may have a higher percentage of ice particles and stronger updrafts which may explain the higher percentage of lightning strikes over land.

It is the collision of ice particles that is believed to generate the electrical charges that discharge as lightning. TRMM's ability to distinguish between various ice and water particles in storms is beginning to shed light on how lightning is produced and under which conditions. The next step would be to use these instruments on a stationary satellite so scientists can watch the entire life cycle of a storm.

VOCABULARY:

Convection currents – the up and down air currents caused by the heating of Earth

Dew point – the temperature at which water vapor becomes a liquid

Energy spectrum – the range of wavelengths of energy from gamma rays to radio waves

Insulator – a substance that resists the flow of electricity

Radar – high frequency radio waves that reflect off surfaces

Super-cooled – a substance is cooled below freezing, yet it remains in liquid form

TRMM – Tropical Rainfall Measuring Mission

Updraft – rising air currents

YOUR THOUGHTS:

1. Why do scientists believe 90% of the lightning occurs over land?
2. Describe how downdrafts eventually cause the death of a thunderstorm?
3. What causes the static charge and lightning in a thunderstorm?
4. How does the TRMM satellite help scientists understand how lightning is produced?

DIAGRAM:

